CLAIMS

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is as follows:

1 1. A method to diagnose equipment failures using an integrated approach of
2 case-based reasoning and reliability analysis, comprising the steps of:
3   maintaining a case base database for the equipment;
4   receiving an equipment problem description from a user;
5   for each component in the equipment, calculating failure probability
6 based on historical failure and published data, using reliability theory;
7   for each component, calculating probability of matching problem
8 description assuming that a component fails, using case based reasoning;
9   for each component, combining the calculated probabilities to compute
10 the overall failure probability given the historical behavior and published data
11 and problem description; and
12   composing a list of component recommendations by ranking
13 components by their overall failure probabilities and retrieving corresponding
14 past solutions from the case base.

1 2. The method of claim 1, further comprising the step of producing a single
2 list of suggested failed components based on published failure data, historical
3 failure behavior as observed by the equipment user, and the problem
4 description specified by the user.

1 3. The method of claim 1, further comprising the step of producing a list of
2 probabilities of failure corresponding to the list of suggested failed
3 components, with the probabilities estimated from published failure data,

4   historical failure behavior as observed by the equipment user, and the problem

5   description specified by the user.

1   4. The method of claim 1, wherein the step of combining probabilities to

2   compute overall failure probability uses an equipment hierarchy such that

3   component failure probabilities are estimated in a hierarchical manner,

4   calculated from data for the equipment at hand, if there is adequate data,

5   otherwise, from data from an equipment group one level up in the hierarchy,

6   and repeating the process until adequate data is found.

1   5. The method of claim 1, wherein the step of combining probabilities to

2   compute overall failure probability uses an equipment hierarchy such that

3   historical cases are retrieved in a hierarchical manner, from data for the

4   equipment at hand, if there is adequate data, otherwise, from data from an

5   equipment group one level up in the hierarchy, and repeating the process until

6   adequate data is found.

1   6. A decision support system to diagnose equipment failures using an

2   integrated approach of case-based reasoning and reliability analysis,

3   comprising:

4   a case base maintenance management system database for the

5   equipment;

6   a decision support system database;

7   a decision support system client for receiving an equipment problem

8   description from a user;

9   a decision support system server receiving input from the decision

10   support system client and accessing said maintenance management system

11   database and said decision support system database, said decision support

12   system server including

13   a real-time decision support system engine for calculating failure

14   probability for each component in the equipment, based on

15   historical failure and published data, using reliability theory,

16   and for calculating probability of matching problem description

17   for each component, assuming that a component fails, using

18   case based reasoning, and for each component, combining the

19   calculated the calculated probabilities to compute the overall

20   failure probability given the historical behavior and published

21   data and problem description and composing a list of

22   component recommendations by ranking components by their

23   overall failure probabilities and retrieving corresponding past

24   solutions from the case base; and

25   a case base update processor for copying closed failure transaction

26   records from the maintenance management systems database,

27   and extracting the information these transaction records to the

28   attributes required by said decision support system engine, and

29   indexing each transaction record by the failed component

30   identification and the number of occurrence of failure of that

31   particular component.

1   7. The decision support system of claim 6, wherein the decision support

2   system server produces a single list of suggested failed components based on

3   published failure data, historical failure behavior as observed by the

4   equipment user, and the problem description specified by the user.

1   8. The decision support system of claim 6, wherein the decision support

2   system server produces a list of probabilities of failure corresponding to the

3   list of suggested failed components, with the probabilities estimated from

4   published failure data, historical failure behavior as observed by the

5   equipment user, and the problem description specified by the user.

1   9. The decision support system of claim 6, wherein the decision support

2   system server combines probabilities to compute overall failure probability

3   uses an equipment hierarchy such that component failure probabilities are

4   estimated in a hierarchical manner, calculated from data for the equipment at

5   hand, if there is adequate data, otherwise, from data from an equipment group

6   one level up in the hierarchy, and repeats the process until adequate data is

7   found.

1   10. The decision support system of claim 6, wherein the decision support

2   system server combines probabilities to compute overall failure probability

3   uses an equipment hierarchy such that historical cases are retrieved in a

4   hierarchical manner, from data for the equipment at hand, if there is adequate

5   data, otherwise, from data from an equipment group one level up in the

6   hierarchy, and repeats the process until adequate data is found.